

Snowmass 2001 Report to HEPAP

Chris Quigg · October 31, 2000

- ▷ A community event organized by the Division of Particles and Fields and Division of Physics of Beams of the American Physical Society
Saturday, June 30 – Saturday, July 21, 2001 in Snowmass, Colorado
Contract signed with Snowmass Association
- ▷ Ron Davidson <rdavidson@pppl.gov> (DPB) and
Chris Quigg <quigg@fnal.gov> (DPF) are leading the organization.
- ▷ Every particle physicist is welcome. We expect ≈ 500 participants.
- ▷ The agenda for Snowmass 2001 will be set by the community.
We are working constructively with the laboratories and science agencies,
and we will call on them for support. (Proposals in preparation)
- ▷ We are encouraging very significant international involvement, and are in
regular communication with leaders from outside the U.S.

We have consulted broadly to formulate Snowmass 2001

- ▷ DPF and DPB executive committees
 - ▷ Users organizations from Brookhaven, Cornell, Fermilab, and SLAC
 - ▷ North-American physicists working at CERN and DESY
 - ▷ Representatives of non-accelerator experiments
 - ▷ Representatives of the linear collider, neutrino factory / muon collider, and very large hadron collider communities
 - ▷ Other physicists representing diverse backgrounds, interests, and experiences:
nuclear physics community: neutrinos, QCD, ...
 - ▷ APS Presidential Line, Other APS officers and staff
 - ▷ Directors of Cornell, Fermilab, and SLAC; CERN, DESY, and KEK
Division Directors of Argonne, Brookhaven, Lawrence Berkeley National Lab, ...
 - ▷ Chair of HEPAP; DOE and NSF officials
 - ▷ Numerous physicists from outside the United States
-

We have received much encouragement and many thoughtful suggestions.

Some Goals of Snowmass 2001

- ▷ Undertake a thematic survey of our vision of particle physics and its future in the most ambitious intellectual terms. Examine different scenarios for the new physics landscape. Within this broad vision, identify the questions we want to address over the next two decades.
- ▷ Looking far beyond the standard model to string theory and to clues that the coming precision cosmology might supply, understand what might lead us to identify new energy scales or frame new experimental programs.
- ▷ Consider the range of instruments that might help us achieve our scientific goals. Gain a community understanding of readiness, capabilities, costs, and technical risks. Compare U.S. efforts with those in the rest of the world. Articulate a program of accelerator R&D that can provide the options we will need in the near and far term.
- ▷ Educate and energize our community to create the future we want.
- ▷ Engage with the public, and with other scientists.

Snowmass 2001 will explore particle physics as a whole

- ▷ Experiments at the highest energies and experiments of exceptional sensitivity; experiments that explore very high scales through virtual effects
- ▷ Accelerator experiments and experiments that use natural sources (land, sea, and sky)
- ▷ Mature subjects and subjects just opening up
- ▷ Theory that develops hand-in-hand with experiment and visionary theory that hasn't yet engaged experimental particle physics directly
- ▷ The interplay between particle physics and technology
- ▷ Accelerators to address a broad range of scientific opportunities
- ▷ The interaction of particle physics with related fields, and with technology
- ▷ ...

Snowmass 2001 Organizing Committee

Particle Physics

Chris Quigg (DPF)
Sally Dawson (BNL)
Paul Grannis (Stony Brook)
David Gross (ITP/UCSB)
Joe Lykken (Fermilab)
Hitoshi Murayama (Berkeley)
René Ong (Chicago → UCLA)
Natalie Roe (LBNL)
Heidi Schellman (Northwestern)
Maria Spiropulu (Chicago)

Accelerators & Technology

Ron Davidson (DPB)
Alex Chao (SLAC)
Alex Dragt (Maryland)
Gerry Dugan (Cornell)
Norbert Holtkamp (Fermilab)
Chan Joshi (UCLA)
Thomas Roser (BNL)
Ron Ruth (SLAC)
John Seeman (SLAC)
Jim Strait (Fermilab)

Other Particle Physics Events in Summer 2001

- ▷ 2001 Particle Accelerator Conference, 18 – 22 June 2001, Chicago, Illinois
 - ▷ 4th Edoardo Amaldi Conference on Gravitational Waves (Amaldi 2001) 7 – 12 July 2001, Perth, Australia
 - ▷ International Conference on High Energy Physics of the European Physical Society 12 – 18 July 2001, Budapest, Hungary
 - ▷ 16th International Conference on General Relativity and Gravitation (GR16) 15 – 21 July 2001, Durban, South Africa
 - ▷ 2001 international Conference on Lepton–Photon Interactions 23 – 27 July 2001, Rome
-

We could not avoid the overlap with the EPS HEP Conference in Budapest. I have conveyed to the organizers our apologies and our good wishes for the success of the conference.

The core of Snowmass—as usual—will be the work of individuals and working groups on scientific and technical issues . . .

. . . but the times and our situation demand additional special efforts:

▷ *Important involvement of students and young physicists*

- Subsidized housing for 50 students
- Young physicists throughout the organization

▷ Educating ourselves: *teach-ins* on

- How *you* can contribute to accelerator R&D
- Experimental implications of string theory ?
- The role of nonaccelerator experiments in particle physics ?

▷ Educating ourselves: *technology school*

- Short courses and lectures on advanced technologies sponsored by IEEE Nuclear and Plasma Science Society

Special efforts ...

▷ Education and outreach

We plan an energetic and diverse program of outreach and education while in Snowmass, to reach the population of Aspen, Snowmass, and surrounding communities, and to display to all of us the many approaches to outreach our colleagues have put into practice.

- ◇ Public lectures and events; online event displays; Particle physics on the mall
- ◇ Physics vans
- ◇ Extensive-air-shower detectors at high schools
- ◇ (Particle) Physics activities in day camps
- ◇ Teacher training (Quarknet + local teachers)

“Science Weekend” in Snowmass, July 7/8, 2001

We will seek support from DOE & NSF, URA, APS, local sources, etc.

Snowmass 2001 Outreach Coordinating Committee

Elizabeth Simmons (Boston University)

Marge Bardeen (Fermilab)

Bill Frazer (Aspen Center for Physics)

Evalyn Gates (Chicago & Adler Planetarium)

Joey Huston (Michigan State)

Ronen Mir (SciTech)

Helen Quinn (SLAC)

Deborah Roudebush (Quarknet teacher, Virginia)

Greg Snow (Nebraska)

Ken Taylor (Quarknet teacher, Texas)

Jeff Wilkes (Washington)

Special efforts . . .

We will produce three documents for the community

- 1) A brief and illustrated **thematic survey** of what particle physics is and aspires to be, guided by the scientific imperatives.

Comment: Documents proceeding from broad scientific goals to specific questions and then to instruments and technology development have been used to excellent effect by NASA. We will produce the thematic survey in final form at the summer study, *with professional help*. It should exist in several formats (printed page, web site, seminar materials, etc.), and in versions for different audiences, including the physics community and the wider public.

We will seek financial (and other) support for this activity

... three documents for the community

2) A community program for accelerator R&D

- ▷ highlighting the historical importance of accelerator R&D to our field, and to science and society at large;
- ▷ making the case for R&D activities not connected with any imminent project;
- ▷ giving—in very broad terms—the needed work, time scales, and levels of effort required to bring us to the point of deciding about different future instruments.

Comment: This document can accomplish several important goals: it will provide a rich timeline of possibilities, with different and overlapping time scales; it will show the importance of preparing possible futures while acting in the present; and it will make the case for all the important R&D activities, instead of creating an all-or-nothing, either/or environment.

We are all in this together.

Some Examples of Accelerator and Technology Topics

- Instruments or Proto-projects
 - ▷ VLHC / SuperLHC
 - ▷ Linear Colliders: NLC/TESLA/JLC, CLIC, giga-Z
 - ▷ Neutrino Factory
 - ▷ Muon Collider
 - ▷ High-luminosity B Factory; B Factory Upgrades
 - ▷ Bright proton source
 - ▷ τ -Charm Factory
 - ▷ Antiproton source / Antimatter Factory
 - ▷ Large circular e^+e^- colliders
 - ▷ Lepton-Hadron Colliders
- Technology Developments
 - ▷ Remote accelerator operation (“global accelerator network”)
 - ▷ Superferric magnets
 - ▷ Superconducting magnets
 - ▷ W-band structures
 - ▷ Advanced simulation techniques
 - ▷ Interplay between particle physics and technology
- Physical Limits to Technology
 - ▷ Laser acceleration
 - ▷ Quantum / diffraction limits
 - ▷ Ultrahigh-field magnets
 - ▷ Superconducting RF beyond Nb
 - ▷ Expendable nanostructures
 - ▷ New materials

... three documents for the community

- 3) A more detailed, but still < 100 -page “white paper” on the field in all its richness and potential.

Comment: In the spirit of the 1994 DPF Committee on Long-Range Planning Report, this document can capture our community’s sense of itself. Organized around scientific and technical goals, rather than laboratory programs, it can serve as important backdrop for future policy decisions.

Work carried out by individuals and working groups for the Summer Study will be reported in the *Proceedings*. We can include working documents or project status reports on a CD-ROM, and on the web. *We will explore innovative ways to publish the work of Snowmass 2001.* (Discussions with ~~American Institute of Physics~~, SLAC eConf, JHEP)

Snowmass 2001 Organizing Committee:

Some comments on mechanics

- ▷ Our community is ready to go. We will create the working groups soon so that people can begin to organize and do work before Snowmass, and self-organized groups can work their way into the Snowmass structure.

The convenors will balance youth and experience, theory and experiment, U.S. and international.

We will pay close attention to integrating the interests of “physics” groups and “accelerator” groups, and to engaging string theorists, nonaccelerator experimenters, ...

- ▷ We will then organize the creation of the coherent accelerator R&D plan.
- ▷ Move on to organizing the thematic survey and the “white paper.”
- ▷ Construct the schedule for the Snowmass workshop itself.

What We Need from You

- ▷ Help us create an atmosphere of inclusion and optimism—a sense of community
The shoot-out mentality is our enemy
- ▷ Come to Snowmass!
First week will have many international leaders
- ▷ Encourage broad participation in Snowmass 2001
No arbitrary limits on participation by lab physicists
- ▷ Financial support for the summer study
Proposals for agency support to DOE, NSF, ...soon
- ▷ Financial support and advice for some of our “exceptional” expenses
- ▷ ...